KYTC STEPS TO DETERMINE AVERAGE SPEEDS FOR USE IN MOBILE 6

1. Initial Speeds (HPMS)
2. Data Collection
3. Rural Speed Estimates
4. Urban Speed Estimates
5. Final DAQ Speed Estimates

* Future Speed Estimation Enhancements

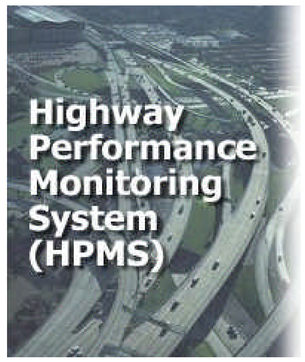
1. Initial Speeds (HPMS)

KYTC's source speed data for the past 10 years was the Highway Performance Monitoring System (HPMS) Analytical Package, which has been discontinued by the Federal Highway Administration. . The most recent data available is from 1997.

1997 HPMS Average Speeds by Functional Class

HPMS Functional Class #	Rural/Urban	Description	1997 HPMS Average Speeds (mph)
1	Rural	Interstate	50.4
2	Rural	Principle Arterial	47.4
6	Rural	Minor Arterial	34.9
7	Rural	Major Collector	31.5
8	Rural	Minor Collector	31.5
9	Rural	Local	31.5
11	Urban	Interstate	49
12	Urban	Freeway	50.5
14	Urban	Principle Arterial	28
16	Urban	Minor Arterial	20.6
17	Urban	Collector	21.1
19	Urban	Local	21.1

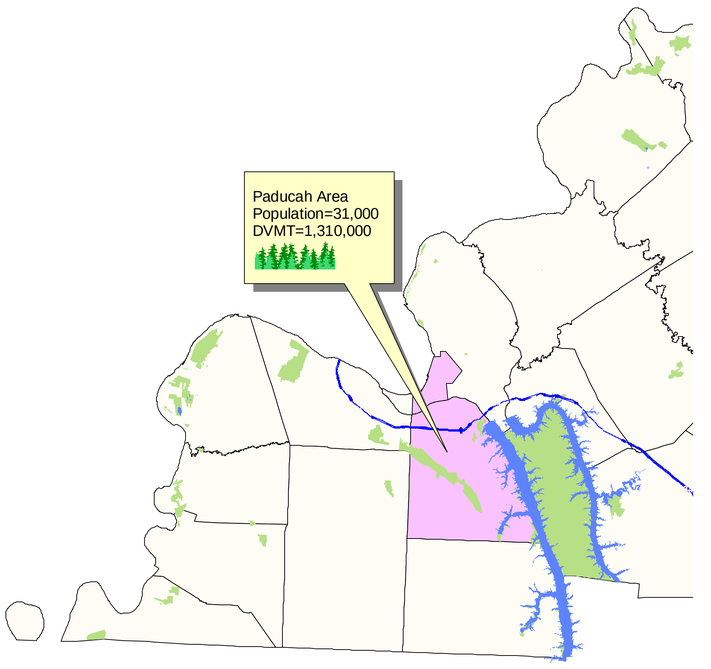
U.S. Department of Transportation Federal Highway Administration



These speed values are inconsistent with actual speed surveys and most people's driving experience. The above table has been the only input into MOBILE for several years by KYTC and our MPOs. **Due to the heightened importance of air quality attainment in highway funding, EPA/DAQ have stressed the need for more accurate speed data.**

HPMS Functional Class #	HERS Average Speeds (mph)	Owensboro Model Average Speeds (mph)	Ashland Model Average Speeds (mph)	Paducah Area Model Average Speeds (mph)	Lexington Area Model Average Speeds (mph)	
					Scott Co.	Fayette Co.
1	71	NA	64.9	64.4	61.6	NA
2	51.6	50.4	40.6	55.4	55	NA
6	42.3	40.2	36.9	54.1	54.2	NA
7	46.1	33.8	35.9	50	50.1	NA
8	NA	32.9	NA	37.6	54.5	NA
9	NA	15.1	10	35	38.6	NA
11	62.9	NA	55	NA	NA	49
12	58.8	54.5	NA	NA	NA	50.5
14	38.9	31.2	31.8	NA	50.6	28
16	37.1	39.3	29.7	NA	41.5	20.6
17	37	30.7	29.5	NA	45	21.1
19	NA	14.1	10	NA	34.7	21.1

* The Louisville Area Model does not compute speeds by HPMS functional class in Jefferson County - only by Mobile6 highway arterial, local, and freeway ramps. The surrounding counties in the Louisville Area use the HERS average speeds.



2. DATA COLLECTION

A.SPOT COUNTS

Spot counts were made by functional class in one county to test the feasibility of collecting speed data using traditional traffic counting equipment.

Data Collection:

- Used parallel road tubes and traffic counters
- Data collected at free flow locations and at locations near intersections
- Data collected for 48-hour periods

Average Speed Data from Spot Counts

HPMS Functional Class #	Average Collected Spot (Instantaneous) Speed (mph)	Average Speed Limit (mph)	# Samples
2	67.4	65	1
6	58.3	55	4
7	56.7	52.5	4
8	65.3	55	4
9	52.2	45	4
12	46.6	55	2
14	58.1	45	1
17	38	35	3
19	28.1	25	4

B.ATR

Other speed data available at spot locations are available at permanent traffic monitoring stations.

Data Collection:

- Used loops as sensors and traffic counters
- Data collected at free flow locations
- Data collected is 48-hour data (available for 365 days if needed)

Average Speed Data from Automatic Traffic Recorders

HPMS Functional Class #	Average Surveyed Instantaneous Speed (mph)	Average Speed Limit (mph)
1	64.7	65
2	59	55
6	41.9	55
7	51.2	55
11	64.6	55
12	56.3	55
14	41.5	55
17	42.2	35

C. ITS

A new source of speed data has emerged in recent years due to the advent of Intelligent Transportation Systems in large cities also known as Advanced Traffic Management Centers (or just TMCs). Kentucky participates in two large TMCs: one is in greater Cincinnati (ARTIMIS) and the other is in Louisville (TRIMARC). TRIMARC's speed data is very accurate.

Free Flow Speed Estimation Using ITS Data, Louisville, KY.

Route	Direction	Average Free Flow Speed (mph)
I-64	East	60.7
I-64	West	59.8
I-65	North	62
I-65	South	57
I-71	North	65.5
I-71	South	65

Data Collection:

- Use loops as sensors
- Data collected at free flow locations
- Data collected on facilities with 55-mp
- Data collected continuously

Data Collection Pros and Cons:

Pros:

- FHWA likes it
- It is a linkage between estimation and

Cons:

- Very expensive
- Variable results

peed Estimation

ern KY odel rage s (mph)
67.7
45.1
38.9
37.5
28.3
28.1
66.3
56.5
33
32.5
28.5
26.7

freeway,

nsboro Area
ulation=91,000
T=2,265,000

Pink Shaded Areas 1 Hour Ozone Maintenance

Northern Kentucky Area
Population=320,000
DVMT=10,500,000

Cincinnati, OH

Louisville Area
Population=780,000
DVMT=24,455,000

Ashland Area
Population=85,000
DVMT=2,488,000

Lexington Area
Population=276,000
DVMT=9,528,000

Edmonson County
Population=11,600
DVMT=328,000
Does not have a TDM

Division
Air Q
Informat
Presen
H

*** FUTU**

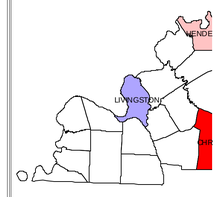
Key future events

- April 15, 2004 – EPA will designate 8-hou
- April 15, 2005 – States must demonstrate
- April 15, 2007 – States must develop Sta

As indicated in "Overview of MOBILE6 Data
local data they wish to use and what they ca
developed will be in place for some time. It
can live with for years to come.

Some tasks KYTC has identified to improve
- Improve use of HERS speed estimates b
- Add speed calibration to traffic demand n
- Encourage research that produces more
- Investigate the use of other local traffic
  explore the use of registration data.

Kentuck



ed limits

al speed data

3. RURAL SPEED ESTIMATES

With data collection considered to be unfeasible, KYTC needed to estimate speeds on rural roads. The following actions were taken:

A.SURVEY OF LITERATURE

The main national sources of information on speed estimation:

- the NCHRP Report 387 Planning Techniques to Estimate Speeds and Service Volumes for Planning Applications
- TMIP Travel Model Speed Estimation and Post Processing Methods for Air Quality Analysis Report
- Highway Capacity Manual

B. RESEARCH

KYTC proposed national research due to lack of national standards on speed estimation.

NCHRP 8-36 proposal action items:

- Review the existing methods of estimating highway speeds in rural and urban areas and make recommendations. This essentially would be a synthesis of existing speed estimation practice.
- Develop a software package for estimating highway speed in rural and urban areas.
- Develop recommended practices for the use of Travel Demand Models (TDMs) to estimate highway speeds.
- Review data collection techniques and recommend verification and/or calibration methods.

C. Speed Estimation Workshop

Dr. Rich Margiotta of Cambridge Systematics, the authority on speed estimation recommended:

- NCHRP 387 equations for free flow speeds (some others are also acceptable)
- HERS equations for congested speeds

D. HERS

Highway Economic Requirements System

- Used for Edmonson County
- Statewide average HERS by Functional Class due to small sample size for Edmonson County.

4. URBAN SPEED ESTIMATES

A. STATUS QUO

TDMs are usually used to produce highway speeds for urban counties with air quality concerns.

TDM speed estimation accuracy concerns:

- Kentucky's TDMs were primarily designed to produce accurate traffic volumes. The calibration process did not involve checking average speeds.
- The modeling process in Kentucky has different levels of accuracy.
- Modeling practice is not standardized.
- KYTC and MPO models do not produce time-of-day speed output.
- The accuracy of the "standard" BPR equation has been questioned in recent years.
- The BPR equation requires a free flow speed estimate as input, which vary significantly from model to model

B.BRAINSTORM

Due to TDM accur
model brainstormir

Based on the
KYTC is transi

- Use of improved
- Use of more acc
- Calibrating mode
- Development of

f Multimodal Programs

lity and Traffic Forecasting

provided by Jesse Mayes and Rob Bostrom
on by David Hamilton and John McCann

Contact Info:

(502) 564-7686

125 Holmes Street A-5
Frankfort, KY 40622

//www.kytc.state.ky.us/multimodal/

SPEED ESTIMATION ENHANCEMENTS

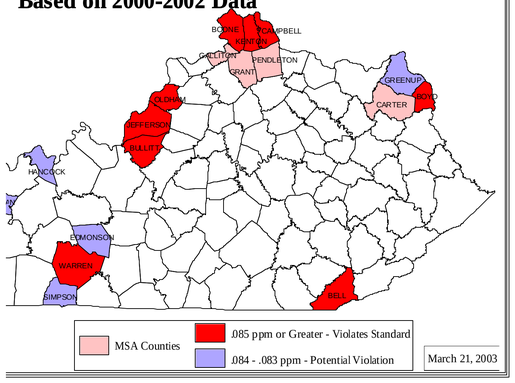
ne areas
formity in new 8-hour areas
plementation Plans (SIP) including motor vehicle emissions budgets (mveb)

uirements", MOBILE6 input can be very complex. States will have to determine what
asonably obtain. Once the new SIPs are completed (by April 15, 2007), the mveb
perative that states have processes and assumptions in place at that time that they

3ILE6 accuracy include:
ng a larger data set. Aim for including speed estimates in KYTC's statewide database.
ing tasks.
dardized methodologies for speed data collection and estimation on the national level.
meters such as VMT by time-of-day, distribution of VMT/speeds by vehicle type and

8-Hour Ozone Areas of Concern

Based on 2000-2002 Data



Background Information

Overview of Kentucky's Air Quality Attainment Issues

In compliance with the Clean Air Act Amendment of 1990, portions, or all, of fifteen Kentucky counties were designated as nonattainment for the National Ambient Air Quality Standard (NAAQS) 1-hour ozone standard. These counties are shown on the map.

These designated areas included:
- three metropolitan areas,
- two small urban areas, and
- two isolated rural areas.

The rural areas presented special problems for demonstrating transportation conformity:
- TDMs did not exist,
- base year traffic volume estimates were difficult to determine accurately, and
- forecasting traffic growth was difficult.

In fact, inaccurate base year estimates and subsequent inaccurate traffic volume forecasts resulted in one of the rural areas going into "lapse" and major projects being delayed for a considerable length of time in the late 1990's.

With the implementation of the new 8-hour ozone standard, effective April 15, 2004, Kentucky is likely to have more rural nonattainment areas.

SUN + CAR + Industry
➡ Ozone

Overview of MOBILE6 Data Requirements

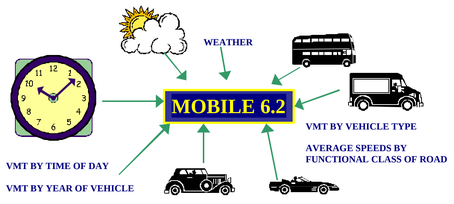
On January 29, 2002, the US Environmental Protection Agency (EPA) officially released the latest motor vehicle emission factor model - **MOBILE6** . This new model allows for much more detailed input such as:
- weather related factors,
- VMT mix by vehicle type,
- VMT distribution by hour and facility type,
- speed information by vehicle type, hour of day and facility type,
- fleet characteristics such as age distribution, and more.

While allowing for detail, local input, the model has built-in national default data and can be run using this data. How well the model output represents local area emission factors, of course, is dependent upon how well the national default data represents local data. It will be up to each state to determine which of the national default data they will replace with local data. This, in turn, will determine where the state spends their resources for determining MOBILE6 input data.

While many factors impact the emission rates, recent studies have found that all pollutant emission rates are sensitive to vehicle speeds associated with all roadway facility types. Additionally, the percentage of vehicle miles traveled (VMT) by highway facility, including the VMT allocation between freeway ramps and freeway mainlines, were found to have a significant effect.

While Kentucky has a good handle on VMT and ramp VMT, speeds are non-existent or calculated inconsistently. For these reasons, the Kentucky Transportation Cabinet has made it a priority to obtain good highway speed data.

MANY THINGS GO INTO MOBILE 6



S SESSION / CHANGES

concerns, the KY Model Users Group sponsored a ssion.

instorming session and recent modeling research, ng towards these travel demand model changes:

R equation parameters;
e free flow speeds ;
r speed in addition to volume; and
dardized modeling procedures for statewide usage.

5. FINAL MOBILE 6 / DAQ SPEED ESTIMATES

A summary of the model speeds used for the 2003 submittal to Division of Air Quality is shown

It is recognized that these speeds are not completely consistent. Nevertheless, KYTC is confident that these speeds are more accurate than the previous submittals to DAQ and that they represent the very best estimates that KYTC can produce at this juncture.